



4-16-01

DA\$

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants: Armand P. Neukermans, et al.

Docket no.: 2149A

Serial no.: 09/729,336

Filed : December 1, 2000

For : FLEXIBLE, MODULAR, COMPACT  
FIBER OPTIC SWITCH

Art Unit : Unknown

Examiner: Unknown

Hon. Commissioner of Patents  
Office of Petitions  
Washington, D.C. 20231

Sir:

Transmitted herewith is a Petition for a Filing Date in the  
patent application identified above .

A check in the amount of \$130.00 accompanies this Petition for  
a Filing Date in payment of the petition fee specified in 37 C.F.R.  
§ 1.17(h).

///

///

///

///

///

///

///

///

///

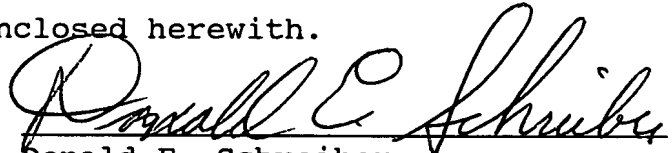
///

RECEIVED

APR 17 2001

OFFICE OF PETITIONS

If any additional fee is due, the Commissioner of Patents is hereby authorized to charge any deficiency or credit any surplus in the enclosed fee to Deposit Account no. 19-0735. A duplicate copy of this transmittal letter is enclosed herewith.

  
Donald E. Schreiber  
Reg. no. 29,435

Dated: April 13, 2001

Donald E. Schreiber  
A Professional Corporation  
Post Office Box 64150  
Sunnyvale, CA 94088-4150

Telephone: (408) 541-9168

Attorney for Applicants



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

EL 763 009 328 US  
"Express Mail" mailing Number

*April* 13, 2001  
Date of Deposit

I hereby certify that this correspondence is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 CFR 1.10 on the date indicated above addressed to the

Commissioner of Patents  
Washington, D.C. 20231

*Marcelle Ivie*  
Marcelle Ivie  
Dated: *April 13*, 2001

Donald E. Schreiber  
A Professional Corporation  
Post Office Box 64150  
Sunnyvale, CA 94088-4150  
(408) 541-9168

Applicants: Armand P. Neukermans, et al.

Docket no.: 2149A

Serial no.: 09/729,336

Filed : December 1, 2000

For : FLEXIBLE, MODULAR, COMPACT  
FIBER OPTIC SWITCH

Art Unit : Unknown

Examiner: Unknown

Hon. Commissioner of Patents  
Office of Petitions  
Washington, D.C. 20231

RECEIVED

APR 17 2001

OFFICE OF PETITIONS

Adjustment date: 07/11/2001 LGIBBS  
04/16/2001 CNGUYEN 00000139 09729336  
01 FC:122 -130.00 OP

Refund Ref:  
07/11/2001 LGIBBS 0000107025

PETITION FOR A FILING DATE

Under

37 C.F.R. § 1.153(e)

CHECK Refund Total: \$130.00

Statement of Facts

1. The application identified above, which is a division of a presently pending parent patent application, was filed with the United States Patent and Trademark Office

04/16/2001 CNGUYEN 00000139 09729336

01 FC:122 130.00 OP

("USPTO") under 37 C.F.R. § 1.53(b) on the date set forth above.

1. Included among the patent application documents filed on that date is a Preliminary Amendment that:
  - a. cancels claims 1-20 of the parent application; and
  - b. presents new claims 21-78.
2. On February 21, 2001, the USPTO dispatched to the Applicants an unsigned "Notice of Incomplete Nonprovisional Application," a copy of which is attached hereto as Exhibit A.
3. The "Notice of Incomplete Nonprovisional Application:"
  - a. reports that a filing date has not been accorded to the above-identified application papers; because
  - b. the specification does not include a written description of the invention.
4. The "Notice of Incomplete Nonprovisional Application" invites, within two months following the February 21, 2001, date, submission either:
  - a. of a newly executed oath or declaration covering the items allegedly not disclosed in the specification; or
  - b. of a petition asserting that the allegedly missing item:
    - i. was submitted, or
    - ii. is not necessary for a filing date.

5. The Applicants hereby respectively assert that, contrary to the allegation set forth on the "Notice of Incomplete Nonprovisional Application," the specification includes a written description of the invention encompassed by claims 21-78 set forth in the Preliminary Amendment.
6. Attached hereto as Exhibit B is a copy of claims 21-78 excerpted from this patent application's Preliminary Amendment that have been annotated with element numbers that appear in various FIGS. of the patent application as originally filed.

**Action Requested**

In view of the facts established by Exhibit B hereto and for the reasons set forth in greater detail below, the Applicants respectfully request:

1. granting the present application the filing date of December 1, 2000, because the application filed under 37 C.F.R. § 1.53(b) on that date included:
  - a. a true and correct copy of the parent patent application which is still currently pending with the USPTO;
  - b. the true and correct copy of the declaration for the parent application; and
  - c. and claims subject matter fully disclosed in the parent patent application; and

2. a refund, in accordance with the statement in the "Notice of Incomplete Nonprovisional Application" dated February 21, 2001, of the fee specified in 37 C.F.R. § 1.17(h) paid for filing this petition.

**Evidence Supporting Petition**

The annotated texts of claims 21-78 appearing in Exhibit B attached hereto establish a correlation between elements of the claims and reference numbers appearing in the patent application's drawings. Because Applicants are able through Exhibit B to demonstrate this correlation, the text of the specification describing the elements identified by those reference numbers must include a written description of the invention encompassed by claims 21-78.

If further evidence could be required that the specification of this patent application includes a written description of the invention encompassed by claims 21-78, the following correlation between specific claims, and portions of claims, and drawing FIGs. should irrefutably establish that the "Notice of Incomplete Nonprovisional Application" was issued improperly.

**Preamble of Independent Claims 21 and 76**

FIGs. 2, 3, 4a, 4b, 5, 6 and 7, together with the text describing those FIGs.

**Body of Independent Claims 21, 67 and 76**

FIGs. 12, 13, 15, 16a, 16b, 16c, 16d, 16e, 21, 22a, 22b, 22c, 22d and 27b, together with the text describing those FIGs.

The following table correlates matter illustrated in various FIGs. in the patent application with the subject matter encompassed by individual dependent claims.

FIG.	Dependent Claim No.
12	40, 41, 49
13	38, 46, 47, 48, 55, 57, 58, 62, 65, 66, 68, 74, 77
15	22, 23, 50, 52, 53, 54, 56, 78
15a	24
15b	25
16a	26, 60
16b	22, 50, 56, 59, 60
16c	26, 27, 42, 60
16d	22, 27, 42, 50, 60
16e	22, 27, 28, 29, 42, 43, 44, 50, 56, 60
17a	30, 45, 63, 64

17b	30, 45, 63, 64
19a	47, 48, 57, 58, 65, 66
19b	47, 48, 57, 58, 65, 66
18a	47, 48, 57, 58, 65, 66
18b	26, 32, 47, 48, 57, 58, 65, 66
20a	26
20b	26
21	22, 50, 56, 61
22a	26, 27, 42
22b	22, 23, 26
22c	27, 42
22d	22, 34, 39, 70
23	51, 56, 75
27b	23, 24, 25, 36, 37, 38, 55, 72, 73, 74, 77, 78

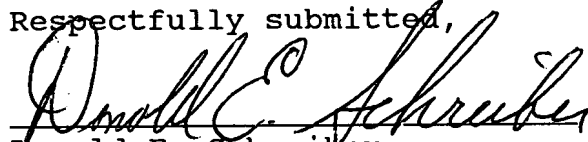
The text of the specification respectively describing each of the FIGs. that the preceding table correlates with dependent claim numbers irrefutably establishes that the present application includes a written description of claims 21-78 presented in the Preliminary Amendment filed on December 1, 2000.



Conclusion

Because, for the reasons set forth above this patent application includes a written description of the invention encompassed by claims 21-78 set forth in the Preliminary Amendment included in the patent application as filed December 1, 2000, the "Notice of Incomplete Nonprovisional Application" dated February 22, 2001, was issued improperly and without justification, and must therefore be immediately withdrawn. Moreover, the fee specified in 37 C.F.R. § 1.17(h) paid for filing this petition must be immediately refunded.

Respectfully submitted,



Donald E. Schreiber  
Reg. No. 29,435

Donald E. Schreiber  
A Professional Corporation  
Post Office Box 64150  
Sunnyvale, California 94088-4150  
(408) 541-9168

Date April 13, 2001

**UNITED STATES PATENT & TRADEMARK OFFICE**  
Washington, D.C. 20231

REQUEST FOR PATENT FEE REFUND												
1 Date of Request: <u>2/9/01</u>		2 Serial/Patent # <u>09/729,336</u>										
3 Please refund the following fee(s):		4 PAPER NUMBER	5 DATE FILED	6 AMOUNT								
	Filing			\$								
	Amendment			\$								
	Extension of Time			\$								
	Notice of Appeal/Appeal			\$								
<input checked="" type="checkbox"/>	Petition	4	4/14/01	\$ 130								
	Issue			\$								
	Cert of Correction/Terminal Disc.			\$								
	Maintenance			\$								
	Assignment			\$								
	Other			\$								
		7 TOTAL AMOUNT OF REFUND		\$ 130								
		8 TO BE REFUNDED BY:										
		<input checked="" type="checkbox"/> Treasury Check										
		Credit Deposit A/C #:										
		9 <table border="1" style="display: inline-table; border-collapse: collapse; text-align: center;"> <tr> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> </tr> </table>										
10 REASON:												
	Overpayment											
	Duplicate Payment											
<input checked="" type="checkbox"/>	No Fee Due (Explanation):											
2/21/01 Notice was PTO error												
11 REFUND REQUESTED BY:												
TYPED/PRINTED NAME: <u>PC TANG</u>		TITLE: <u>Petitioner Atty</u>										
SIGNATURE: <u>PC TANG</u>		PHONE: <u>703-308-0763</u>										
OFFICE: <u>Petitioner</u>												
***** THIS SPACE RESERVED FOR FINANCE USE ONLY: *****												
APPROVED: <u>Hiana Chase</u>		DATE: <u>7/11/01</u>										

Instructions for completion of this form appear on the back. After completion, attach white and yellow copies to the official file and mail or hand-carry to:

**Office of Finance  
Refund Branch  
Crystal Park One, Room 802B**



## UNITED STATES PATENT AND TRADEMARK OFFICE

COMMISSIONER FOR PATENTS  
UNITED STATES PATENT AND TRADEMARK OFFICE  
WASHINGTON, D.C. 20231  
www.uspto.gov

APPLICATION NUMBER	FILING/RECEIPT DATE	FIRST NAMED APPLICANT	ATTORNEY DOCKET NUMBER
09/729,336	12/01/2000	Arnold P. Neukermans	2149A

CONFIRMATION NO. 6278

## FORMALITIES LETTER



\*OC000000005685945\*

Id E. Schreiber  
Professional Corporation  
Office Box 64150  
Hayward, CA 94088-4150

Date Mailed: 02/21/2001

## NOTICE OF INCOMPLETE NONPROVISIONAL APPLICATION

FILED UNDER 37 CFR 1.53(b)

A filing date has NOT been accorded to the above-identified application papers for the reason(s) indicated below.

All of the items noted below and a newly executed oath or declaration covering the items must be submitted within **TWO MONTHS** of the date of this Notice, unless otherwise indicated, or proceedings on the application will be terminated (37 CFR 1.53(e)).

The filing date will be the date of receipt of all items required below, unless otherwise indicated. Any assertions that the item(s) required below were submitted, or are not necessary for a filing date, must be by way of petition directed to the attention of the Office of Petitions accompanied by the \$130.00 petition fee (37 CFR 1.17(i)). If the petition states that the application is entitled to a filing date, a request for a refund of the petition fee may be included in the petition.

- The specification does not include a written description of the invention.

*A copy of this notice **MUST** be returned with the reply.*

Customer Service Center  
Initial Patent Examination Division (703) 308-1202  
PART 1 - ATTORNEY/APPLICANT COPY



## UNITED STATES PATENT AND TRADEMARK OFFICE

COMMISSIONER FOR PATENTS  
UNITED STATES PATENT AND TRADEMARK OFFICE  
WASHINGTON, D.C. 20231  
www.uspto.gov

APPLICATION NUMBER	FILING/RECEIPT DATE	FIRST NAMED APPLICANT	ATTORNEY DOCKET NUMBER
09/729,336	12/01/2000	Arnold P. Neukermans	2149A

CONFIRMATION NO. 6278

## FORMALITIES LETTER



\*OC000000005685945\*

Donald E. Schreiber  
A Professional Corporation  
Post Office Box 64150  
Sunnyvale, CA 94088-4150

Date Mailed: 02/21/2001

## NOTICE OF INCOMPLETE NONPROVISIONAL APPLICATION

## FILED UNDER 37 CFR 1.53(b)

A filing date has NOT been accorded to the above-identified application papers for the reason(s) indicated below.

All of the items noted below and a newly executed oath or declaration covering the items must be submitted within **TWO MONTHS** of the date of this Notice, unless otherwise indicated, or proceedings on the application will be terminated (37 CFR 1.53(e)).

The filing date will be the date of receipt of all items required below, unless otherwise indicated. Any assertions that the item(s) required below were submitted, or are not necessary for a filing date, must be by way of petition directed to the attention of the Office of Petitions accompanied by the \$130.00 petition fee (37 CFR 1.17(i)). If the petition states that the application is entitled to a filing date, a request for a refund of the petition fee may be included in the petition.

- The specification does not include a written description of the invention.

---

*A copy of this notice **MUST** be returned with the reply.*

---

Customer Service Center

Initial Patent Examination Division (703) 308-1202

PART 2 - COPY TO BE RETURNED WITH RESPONSE

**EXHIBIT B**

**CLAIMS 21-78 ANNOTATED WITH REFERENCE NUMBERS**

21. (New) A light beam deflector assembly (222) adapted for use in a fiber optic switching module (100) that includes:

a first and a second group of collimator receptacles (154) which are separated from each other at opposite ends (102a and 102b) of a free space optical path with each collimator receptacle (154) being respectively adapted for receiving and fixing an end (104) of an optical fiber (106); and

lenses (112) that are supported within the fiber optic switching module (100) each juxtaposed with the end (104) of one optical fiber (106) fixable in the collimator receptacles (154), and disposed with respect to the end (104) of that optical fiber (106) so a beam of light (108) emittable from the end (104) passes through the lens (112) to propagate as a quasi-collimated beam (108) within the optical path from the lens (112) toward the second or toward the first group of collimator receptacles (154);

the light beam deflector assembly (222) being positionable along the optical path between the groups of collimator receptacles (154) so at least one quasi-collimated beam of light (108) propagatable from at least one of the lenses (112) impinges thereon, the light beam deflector assembly (222) comprising:

(a) a substrate (212); and

(b) a plurality of reflective light beam deflectors (172) that are fixed to a surface of said substrate (212) which respectively:

i. are:

(1) associated with one of the lenses (112);

(2) positioned so the quasi-collimated beam of light (108) propagatable from the associated lens (112) impinges upon one of said light beam deflectors (172) to be reflected therefrom; and

(3) energizable by drive signals supplied to said substrate (212) for orienting the light beam deflectors (172) fixed thereto so the quasi-collimated beam of light (108) propagatable from the associated lens (112), that reflects off the one of said light beam deflectors (172), also reflects off another selected light beam deflector (172) that is also:

A. positionable along the optical path between the groups of collimator receptacles (154);

B. energizable by drive signals supplied to said fiber optic switching module (100); and

C. associated with one of the lenses (112);

whereby a pair of light beam deflectors (172), one light beam deflector (172) of the pair included in the light beam deflector assembly (222), when selected and oriented by drive signals supplied respectively thereto, establish an optical coupling by which a beam of light (108) propagating through the optical path

from the end (104) of one optical fiber (106) fixable in the collimator receptacle (154) either of the first or of the second group is reflectable sequentially off the pair of energized light beam deflectors (172) into a selected one of the optical fibers (106) fixable at the second or at the first group of collimator receptacles (154).

22. (New) The light beam deflector assembly (222) of claim 21 wherein the substrate (212) is formed from an electrically insulating material.

23. (New) The light beam deflector assembly (222) of claim 22 wherein said substrate (212) has electrically conductive electrodes (214) formed on the surface to which said light beam deflectors (172) are fixed, and wherein the drive signals supplied  
5 to said substrate (212) generate an electrostatic force between said electrodes (214) and said light beam deflector (172) to energize orientation of said light beam deflectors (172) fixed to said substrate (212).

24. (New) The light beam deflector assembly (222) of claim 23 wherein areas on said electrodes (214) of possible contact with said light beam deflectors (172) are at least partially overcoated with electrically insulating material (219).

25. (New) The light beam deflector assembly (222) of claim 23 wherein areas on said electrodes (214) of possible contact with said light beam deflectors (172) are pierced by holes (220).

26. (New) The light beam deflector assembly (222) of claim 22 wherein said light beam deflectors (172) are organized as a group.

27. (New) The light beam deflector assembly (222) of  
5 claim 26 wherein the substrate (212) has a width that does not substantially exceed a width of the group of light beam deflectors (172) fixed thereto.

28. (New) The light beam deflector assembly (222) of claim 27 wherein an of the light beam deflector assembly (222) that is free of light beam deflectors (172) is juxtaposable with an of another light beam deflector assembly (222) that is includable  
5 in the fiber optic switching module (100), positionable along the optical path, and also free of light beam deflectors (172).

29. (New) The light beam deflector assembly (222) of claim 28 wherein light beam deflectors (172) included therein are offsetable from light beam deflectors (172) included in a second light beam deflector assembly (222) that is juxtaposable therewith.

30. (New) The light beam deflector assembly (222) of claim 26 wherein the group of light beam deflectors (172) is



rectangularly-shaped, and wherein each light beam deflector (172) fixed to said substrate (212) is supported by hinges (176, 182) for rotation about an axis that is oriented substantially parallel to an axis of the rectangularly-shaped group of light beam deflectors (172).

31. (New) The light beam deflector assembly (222) of claim 26 wherein said substrate (212) is elongated, and wherein each light beam deflector (172) fixed to said substrate (212) is supported by hinges (176, 182) for rotation about an axis that is oriented substantially perpendicular to a longitudinal axis of said elongated substrate (212).

32. (New) The light beam deflector assembly (222) of claim 26 wherein each light beam deflector (172) fixed to said substrate (212) is supported by hinges (176, 182) for rotation about an axis that is oriented at an angle of approximately forty-five degrees ( $45^\circ$ ) to an axis of the group of light beam deflectors (172).

33. (New) The light beam deflector assembly (222) of claim 22 wherein the substrate (212) is fabricated from material selected from a group consisting of silicon, polysilicon, Pyrex glass, aluminum oxide and aluminum nitride.

34. (New) The light beam deflector assembly (222) of claim 33 wherein the substrate (212) is pierced by insulated, electrically-conductive vias (282) that provide electrical connections to said light beam deflectors (172).

35. (New) The light beam deflector assembly (222) of claim 33 wherein the substrate (212) has integrated circuits integrated therein or thereon.

36. (New) The light beam deflector assembly (222) of claim 35 wherein said substrate (212) has electrically conductive electrodes (214) formed on the surface to which said light beam deflectors (172) are fixed, and wherein the drive signals supplied  
5 to said substrate (212) for each of said light beam deflectors (172) are received by amplifiers (463) that are included in the light beam deflector assembly (222) for supplying voltage signals to said electrodes (214) to generate an electrostatic force between said electrodes (214) and said adjacent light beam deflector (172).

37. (New) The light beam deflector assembly (222) of claim 35 wherein the integrated circuits include amplifiers (463) that receive s which indicate light beam deflector orientation.

38. (New) The light beam deflector assembly (222) of claim 37 wherein each light beam deflector (172) fixed to said substrate (212) is supported for rotation by hinges (176, 182)

which include at least one torsion sensor (192a, 192b) for sensing  
5 light beam deflector orientation, the torsion sensors (192a, 192b)  
of said light beam deflectors (172) supplying the s to at least one  
amplifier (463) included in the light beam deflector assembly  
(222).

39. (New) The light beam deflector assembly (222) of  
claim 21 wherein the substrate (212) is pierced by insulated,  
electrically-conductive vias (282) that provide electrical  
connections to said light beam deflectors (172).

40. (New) The light beam deflector assembly (222) of  
claim 21 wherein said light beam deflectors (172) are  
monolithically fabricated from a single-crystal semiconductor layer  
of a silicon wafer (162).

41. (New) The light beam deflector assembly (222) of  
claim 40 wherein several light beam deflectors (172) fixed to said  
substrate (212) are monolithically fabricated as a one-piece group  
from the single-crystal semiconductor layer of a single silicon  
5 wafer (162).

42. (New) The light beam deflector assembly (222) of  
claim 41 wherein the substrate (212) has a width that does not  
substantially exceed a width of the group of light beam deflectors  
(172) fixed thereto.

43. (New) The light beam deflector assembly (222) of claim 42 wherein an of the light beam deflector assembly (222) that is free of light beam deflectors (172) is juxtaposable with an of another light beam deflector assembly (222) that is includable  
5 in the fiber optic switching module (100), positionable along the optical path, and also free of light beam deflectors (172).

44. (New) The light beam deflector assembly (222) of claim 43 wherein light beam deflectors (172) included therein are offsetable from light beam deflectors (172) included in a second light beam deflector assembly (222) that is juxtaposable therewith.

45. (New) The light beam deflector assembly (222) of claim 41 wherein at least two, one-piece groups of light beam deflectors (172) are fixed to said substrate (212).

46. (New) The light beam deflector assembly (222) of claim 40 wherein light beam deflectors (172) respectively include:

an outer frame (174);

first torsional hinges (176, 182) that project inwardly from  
5 the outer frame (174);

an inner frame (178) supported by the first torsional hinges (176, 182) for rotation about a first axis;

second torsional hinges (176, 182) that project inwardly from the inner frame (178); and

10 a central plate (184) that is supported by the second torsional hinges (176, 182) for rotation about a second axis that is not oriented parallel to the first axis, and that has a reflective mirror surface (116a, 116b) formed thereon.

47. (New) The light beam deflector assembly (222) of claim 46 wherein the central plate (184) of light beam deflectors (172) has a width that exceeds a height of the central plate (184) measured perpendicular to the width thereof.

48. (New) The light beam deflector assembly (222) of claim 47 wherein the width of said light beam deflector (172) equals approximately 1.4 times the height thereof.

49. (New) The light beam deflector assembly (222) of claim 40 wherein the silicon wafer (162) includes a device layer (166) and a handle layer (168), and said light beam deflectors (172) are formed in the device layer (166) of the silicon wafer  
5 (162).

50. (New) The light beam deflector assembly (222) of claim 49 wherein said light beam deflectors (172) are fixed to the substrate (212) with the device layer (166) of the silicon wafer (162) disposed nearest to the substrate (212), and the handle layer  
5 (168) disposed further from the substrate (212).

51. (New) The light beam deflector assembly (222) of claim 50 wherein the handle layer (168) surrounding each of the light beam deflectors (172) is coated with an anti reflection layer (312) to absorb stray light from the quasi-collimated beam of light (108) impinging thereon.

52. (New) The light beam deflector assembly (222) of claim 49 wherein hinges (176, 182) which support said light beam deflector (172) for rotation about an axis, that are also formed in the device layer (166) of the silicon wafer (162), are thinner than the device layer (166) of the silicon wafer (162).

53. (New) The light beam deflector assembly (222) of claim 49 wherein a surface of said light beam deflector (172) upon which the quasi-collimated beam of light (108) does not directly impinge has a cavity formed therein which is surrounded by a reinforcing rim.

54. (New) The light beam deflector assembly (222) of claim 21 further comprising a plurality of light beam deflector orientation sensors at least one of which is associated respectively with each of said light beam deflectors (172).

55. (New) The light beam deflector assembly (222) of claim 54 wherein each light beam deflector (172) fixed to said substrate (212) is supported for rotation by hinges (176, 182), and

wherein said light beam deflector orientation sensor includes at  
5 least one torsion sensor (192a, 192b) formed in the hinges (176,  
182).

56. (New) The light beam deflector assembly (222) of  
claim 21 wherein the quasi-collimated beam of light (108) impinges  
obliquely upon the light beam deflector (172) to reflect obliquely  
therefrom.

57. (New) The light beam deflector assembly (222) of  
claim 56 wherein each light beam deflector (172) has a width in a  
plane established by the impinging and reflected quasi-collimated  
beam of light (108) which exceeds a height perpendicular to the  
5 plane.

58. (New) The light beam deflector assembly (222) of  
claim 57 wherein the width of said light beam deflector (172)  
equals approximately 1.4 times the height thereof.

59. (New) The light beam deflector assembly (222) of  
claim 21 adapted for overlapping with another light beam deflector  
assembly (222) that is includable in the fiber optic switching  
module (100) and positionable along the optical path.

60. (New) The light beam deflector assembly (222) of claim 21 adapted for coupling to a ribbon cable (226) by which the drive signals are supplied to said light beam deflectors (172).

61. (New) The light beam deflector assembly (222) of claim 21 wherein a mirror surface (262) is disposed along a surface of said substrate (212) which is distal from the surface thereof to which said light beam deflectors (172) are fixed, the light beam  
5 deflector assembly (222) being:

juxtaposable with a second light beam deflector assembly (222) includable in the fiber optic switching module (100) and positionable in the optical path thereof, the second light beam deflector assembly (222) also having a mirror surface  
10 (262) disposed along a surface of the substrate (212) of the second light beam deflector assembly (222); and

configurable with respect to the mirror surface (262) of the second light beam deflector assembly (222) so the quasi-collimated beam of light (108) that impinges upon light  
15 beam deflector (172) first impinges on and is reflected from the mirror surface (262) disposed on the adjacent substrate (212) of the second light beam deflector assembly (222).

62. (New) The light beam deflector assembly (222) of claim 21 wherein light beam deflectors (172) respectively include:  
an outer frame (174);



first torsional hinges (176, 182) that project inwardly from  
5 the outer frame (174);

an inner frame (178) supported by the first torsional hinges  
(176, 182) for rotation about a first axis;

second torsional hinges (176, 182) that project inwardly from  
the inner frame (178); and

10 a central plate (184) that is supported by the second  
torsional hinges (176, 182) for rotation about a second axis that  
is not oriented parallel to the first axis, and that has a  
reflective mirror surface (116a, 116b) formed thereon.

63. (New) The light beam deflector assembly (222) of  
claim 62 wherein said light beam deflectors (172) are organized as  
a group having an axis to which the second axis of light beam  
deflectors (172) is oriented substantially parallel.

64. (New) The light beam deflector assembly (222) of  
claim 63 wherein the first axis of light beam deflectors (172) is  
oriented substantially perpendicular to an axis of the group of  
said light beam deflectors (172).

65. (New) The light beam deflector assembly (222) of  
claim 63 wherein the central plate (184) of light beam deflectors  
(172) has a width perpendicular to the axis of the group of said  
light beam deflectors (172) that exceeds a height of the central

5 plate (184) parallel to the axis of the group of said light beam deflectors (172).

66. (New) The light beam deflector assembly (222) of claim 65 wherein the width of said light beam deflector (172) equals approximately 1.4 times the height thereof.

67. (New) A flip-chip light beam deflector assembly (222) comprising:

a substrate (212); and

a reflective light beam deflector (172) that is monolithically  
5 fabricated from a single-crystal semiconductor layer of a silicon wafer (162) that includes a device layer (166) and a handle layer (168), said light beam deflector (172) being fixed to a surface of said substrate (212) with the device layer (166) of the silicon wafer (162) disposed nearest to the substrate (212), and the handle  
10 layer (168) disposed further from the substrate (212), said light beam deflector (172) being energizable by a drive signal supplied to said substrate (212) for orienting said light beam deflector (172).

68. (New) The flip-chip light beam deflector assembly (222) of claim 67 wherein said light beam deflector (172) is formed in the device layer (166) of the silicon wafer (162).

69. (New) The flip-chip light beam deflector assembly (222) of claim 67 wherein the substrate (212) is fabricated from material selected from a group consisting of silicon, polysilicon, Pyrex glass, aluminum oxide and aluminum nitride.

70. (New) The flip-chip light beam deflector assembly (222) of claim 69 wherein the substrate (212) is pierced by insulated, electrically-conductive vias (282) that provide electrical connections to said light beam deflector (172).

71. (New) The flip-chip light beam deflector assembly (222) of claim 69 wherein the substrate (212) has an integrated circuit therein or thereon.

72. (New) The flip-chip light beam deflector assembly (222) of claim 71 wherein said substrate (212) has an electrically conductive electrode (214) formed on the surface thereof to which said light beam deflector (172) is fixed, and wherein the drive  
5 signal supplied to said substrate (212) is received by an amplifier (463) that is included in the integrated circuit for supplying a voltage signal to said electrode (214) to generate an electrostatic force between said electrode (214) and said light beam deflector (172) adjacent thereto.

73. (New) The flip-chip light beam deflector assembly (222) of claim 71 wherein the integrated circuit includes an

amplifier (463) that receives an which indicates light beam deflector orientation.

74. (New) The flip-chip light beam deflector assembly (222) of claim 73 wherein said light beam deflector (172) fixed to said substrate (212) is supported for rotation by hinges (176, 182) which include at least one torsion sensor (192a, 192b) for sensing  
5 light beam deflector orientation, the torsion sensor (192a, 192b) of said light beam deflector (172) supplying the to at least one amplifier (463).

75. (New) The flip-chip light beam deflector assembly (222) of claim 67 wherein the handle layer (168) surrounding each of the light beam deflectors (172) is coated with an anti reflection layer (312) to absorb stray light impinging thereon.

76. (New) A light beam deflector assembly (222) adapted for use in a fiber optic switching module (100) that includes:

a first and a second group of collimator receptacles (154) which are separated from each other at opposite ends  
5 (102a and 102b) of a free space optical path with each collimator receptacles (154) being respectively adapted for receiving and fixing an end (104) of an optical fiber (106); and

lenses (112) that are supported within the fiber optic  
10 switching module (100) each juxtaposed with the end (104) of

one optical fiber (106) fixable in the collimator receptacles (154), and disposed with respect to the end (104) of that optical fiber (106) so a beam of light (108) emittable from the end (104) passes through the lens (112) to propagate as a  
15 quasi-collimated beam (108) within the optical path from the lens (112) toward the second or toward the first group of collimator receptacles (154);

the light beam deflector assembly (222) being positionable along the optical path between the groups of collimator receptacles  
20 (154) so at least one quasi-collimated beam of light (108) propagatable from at least one of the lenses (112) impinges thereon, the light beam deflector assembly (222) comprising:

(a) a substrate (212); and

(b) a plurality of reflective light beam deflectors (172)  
25 that are fixed to a surface of said substrate (212) which respectively:

i. are:

(1) associated with one of the lenses (112);

(2) positioned so the quasi-collimated beam of  
30 light (108) propagatable from the associated lens (112) impinges upon one of said light beam deflectors (172) to be reflected therefrom; and

(3) energizable by drive signals supplied to said  
substrate (212) for orienting the light beam deflectors  
35 (172) fixed thereto so the quasi-collimated beam of light (108) propagatable from the associated lens (112), that

reflects off the one of said light beam deflectors (172), also reflects off another selected light beam deflector (172) that is also:

- 40           A.   positionable along the optical path between the groups of collimator receptacles (154);
- B.   energizable by drive signals supplied to said fiber optic switching module (100); and
- C.   associated with one of the lenses (112);
- 45           and

        ii. include an orientation sensor for generating an orientation signal which indicates orientation of said light beam deflector (172); and

        (c) an amplifier (463) which receives the orientation signal

50 from the orientation sensor of said light beam deflector (172);

        whereby a pair of light beam deflectors (172), one light beam deflector (172) of the pair included in the light beam deflector assembly (222), when selected and oriented by drive signals supplied respectively thereto, establish an optical coupling by

55 which a beam of light (108) propagating through the optical path from the end (104) of one optical fiber (106) fixable in the collimator receptacle (154) either of the first or of the second group is reflectable sequentially off the pair of energized light beam deflectors (172) into a selected one of the optical fibers

60 (106) fixable at the second or at the first group of collimator receptacles (154).

77. (New) The light beam deflector assembly (222) of claim 76 wherein each light beam deflector (172) fixed to said substrate (212) is supported for rotation by hinges (176, 182), and wherein said light beam deflector orientation sensor includes at least one torsion sensor (192a, 192b) formed in one of the hinges (176, 182).

78. (New) The light beam deflector assembly (222) of claim 76 wherein said substrate (212) has electrically conductive electrodes (214) formed on the surface to which said light beam deflectors (172) are fixed, and wherein the drive signals supplied to said substrate (212) for each of said light beam deflectors (172) are received by amplifiers (463) that are included in the light beam deflector assembly (222) for supplying voltage signals to said electrodes (214) to generate an electrostatic force between said electrodes (214) and said immediately adjacent light beam deflector (172).